Bachelor of Science (F.Y.B.Sc.) Second Semester Old

2S-PHY 202 - Physics Paper-II (Electric Currents, Motion of Charged Particles in Electric and Magnetic Fields, Electromagnetic Waves)

P. Pages : 3 **GUG/W/18/1249**

Time : Three Hours * 0 9 6 2 * Max. Marks : 50

Notes : 1. All questions are compulsory.
2. Draw neat labelled diagram wherever necessary.

1. Either

a) i) Discuss the theory of oscillatory discharge of condenser through a resistor and an inductor. **4**

ii) Obtain the expression for frequency of oscillation. Also find the maximum value of resistance so that the circuit can just oscillate. **4**

iii) Find whether the discharge of the capacitor in an LCR circuit in which $C = 0.1\ \mu F,\ L = 10\,mH,\ R = 200\,\Omega$ is oscillatory. **2**

OR

b) i) Using i-operator method, obtain an expression for an alternating current in series LCR circuit. **4**

ii) Determine an expression for the magnitude of the impedance and phase difference between current and e.m.f. using i-operator. **4**

iii) An a.c. circuit has R = 10 ohm, L = 0.05 H and C = 20 μF. Find the resonant frequency of the circuit. **2**

2. Either

a) i) Draw the block diagram of CRO. Explain the function of each block Give uses of CRO. **7**

ii) Determine the deflection sensitivity of a signal for a CRT in which length of deflecting plates is 2 cm separated by 0.5 cm. The distance of the screen from the centre of the deflecting plates is 30 cm. An accelerating potential difference is 2000V. **3**

OR

b) i) Write the Maxwell's equations. Explain the physical significance of each equation. **4**

ii) If E and H represent the electric and magnetic field respectively in a plane electromagnetic waves then show that $\frac{E}{H} = \sqrt{\frac{\mu_0}{\epsilon_0}}$ **4**

iii) A radio station radiates power 10^5 watts uniformly over a hemisphere concentric with the station. Find the magnitude of Poynting vector at a point 10 kms from the radio station. **2**

3. Either

a) Apply Kirchhoff's laws to deduce the condition of balance of Wheatstone bridge. **2½**

b) Calculate the radius of path of an electron in a magnetic field of induction $10^{-4}\ Wb/m^2$ perpendicular to its path. **2½**

(Given : Velocity of electron = $1.9 \times 10^8\ m/s$

mass of electron = 9.1×10^{-31} kg

charge of electron = $1.6 \times 10^{-19}\ C$)

c) Describe the principle and construction of a cyclotron. **2½**

d) Obtain the expression for energy stored in magnetic field. **2½**

OR

e) What resistance must be connected in series with an inductance of 0.2H in order that the phase difference between the applied emf and current should be 45° when frequency of applied emf is $60H_z$. **2½**

f) Show that magnetic deflection sensitivity is inversely proportional to the square root of the accelerating voltage. **2½**

g) Explain the working of a linear accelerator. **2½**

h) Write down Maxwell's equations for free space and prove that the velocity of plane electromagnetic waves in free space is **2½**

$$\frac{1}{\sqrt{\mu_0 \in_0}} \quad \text{where} \quad \in_0 = 8.85 \times 10^{-12}\ \text{S.I.unit}, \quad \mu_0 = 4\pi \times 10^{-7}\ \text{SI unit}$$

4. Either

a) Derive an expression for the decay of current in LR circuit. **2½**

b) Distinguish between series and parallel resonance circuit. **2½**

c) In Thomson's parabola method, parabolic traces were obtained on the photographic plate for neon and hydrogen ions. The x-coordinates of the points of inter-section of a straight line parallel to the x-axis with parabolic traces were 4.77mm, 5.00mm and 22.4mm. Find the atomic masses of the isotopes of neon. (atomic mass of H= 1 a.m.u.) **2½**

d) Explain the characteristics of electromagnetic waves. **2½**

OR

e) Derive an expression for growth of charge in CR circuit. **2½**

f) What is velocity selector? Explain its working. **2½**

g) What would be the length of the last drift tube in a linear accelerator which produces 120MeV C^{12} oins, using frequency of 70 MHz? **2½**

$(1eV = 1.6 \times 10^{-19}\ s$ and $1a\ m.u. = 1.66 \times 10^{-27}\ kg)$

h) Explain the physical significance of poynting vector. What is its unit? **2½**

5. Attempt **any ten** of the followings.

a) Show that inductive time constant has the dimensions of time. **1**

b) Find the reactance of a capacitor of capacity $1\mu F$ at $1KHz$ frequency. **1**

c) What is j-operator? **1**

d) Define quality factor. **1**

e) What is power factor? **1**

f) Define magnetic deflection sensitivity. **1**

g) What is mean by isotopes? **1**

h) What are positive x-rays. **1**

i) State the limitations of cyclotron? **1**

j) Show the propagation of electromagnetic wave in x-direction graphically. **1**

k) Explain the term 'Displacement Current'. **1**

l) Define characteristics impedance to electromagnetic waves. **1**

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